JC13 Rec'd PCT/PTO 28 MAR 2001

FORM PTO-1390 US DEPARTMENT OF COMMERCE
REV. 5-93PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEYS DOCKET NUMBER
P01,0047

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)
09/806265

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/03056	**23 September 1999**	**30 September 1998**

TITLE OF INVENTION
METHOD FOR CONNECTING TERMINALS TO A EXCHANGE VIA A COMMUNICATIONS NETWORK

APPLICANT(S) FOR DO/EO/US
WOLFGANG FRAAS ET AL.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report, References).**
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ☒ Preliminary Amendment
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification and substitute specification mark-up.
15. ☒ A change of address letter attached to the Declaration.
16. ☒ Other items or information:
    a. ☒ Submission of Drawings for publication and drawing changes
    b. ☒ EXPRESS MAIL #EL 843728067 US dated March 28, 2001

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5) 09/806265	INTERNATIONAL APPLICATION NO. PCT/DE99/03056	ATTORNEY'S DOCKET NUMBER P01,0047

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO $860.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) $690.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) $710.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO $1000.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

Claims	Number Filed		Number Extra	Rate		
Total Claims	07	- 20 =	0	X $ 18.00	$	
Independent Claims	02	- 3 =	0	X $ 80.00	$	
Multiple Dependent Claims				$270.00 +	$	
TOTAL OF ABOVE CALCULATIONS =					$ 860.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$	
SUBTOTAL =					$ 860.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$	
TOTAL NATIONAL FEE =					$ 860.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +						
TOTAL FEES ENCLOSED =					$ 860.00	
					Amount to be refunded	$
					charged	$

a. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1519. **A duplicate copy of this sheet is enclosed.**

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

SCHIFF HARDIN & WAITE
PATENT DEPARTMENT
6600 Sears Tower
233 South Wacker Drive
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CUSTOMER NUMBER 26574

Steven H. Noll
SIGNATURE

Steven H. Noll
NAME

28,982
Registration Number

IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

"**PRELIMINARY AMENDMENT**"

APPLICANT: Wolfgang FRAAS et al.

DOCKET NO: P01,0047

INTERNATIONAL APPLICATION NO.: PCT/DE99/03056

INTERNATIONAL FILING DATE: 23 September 1999

INVENTION: METHOD FOR CONNECTING TERMINALS TO A EXCHANGE VIA A COMMUNICATIONS NETWORK

Hon. Assistant Commissioner for Patents
Box PCT
Washington D.C. 20231

SIR:

Amend the above-identified international application before entry into the national stage before the U.S. Patent & Trademark Office under 35 U.S.C. §371 as follows:

IN THE SPECIFICATION

Please substitute the specification in the file with the enclosed substitute specification in compliance with 37 CFR 1.125(b). Furthermore, a separate marked up copy of the specification that shows all changes relative to the previous specification is also enclosed.

IN THE CLAIMS

Please cancel all claims without prejudice and add new claims 8-14 as follows.

WE CLAIM:

8. A method for transmitting data from communication terminals to a switching system via a packet-oriented communication network, comprising the steps of:

setting up a data format formed of substructural elements for a data transmission between a switching system and communication terminals, said communication terminals being connected to a packet oriented communication network via a hub, said communication terminals further being connected to said switching system via an access unit,

transmitting said data in a form of substructural elements to said hub via a communication terminal,

inserting said substructural elements in to data packets via said hub,

transmitting said data packets to the access unit via the packet oriented communication network,

extracting said substructural elements from said data packets via said access unit, and;

forwarding said substructural elements to said switching system.

9. A method for transmitting data from a switching system to communication terminals via a packet-oriented communication network, comprising the steps of:

setting up a data format formed of substructural elements for a data transmission between a switching system and communication terminals, said communication terminals being connected to a packet oriented communication network via a hub, said communication terminals further being connected to said switching system via an access unit,

transmitting said data in a form of substructural elements to the access unit via said switching system,

inserting said substructural elements in to data packets via said access unit,

transmitting said data packets to the hub via the packet oriented communication network,

extracting said substructural elements from said data packets via said hub, and;

forwarding said substructural elements to a corresponding communication terminal.

10. A method according to claim 8, wherein said data packets are structured as Internet Protocol data packets.

11. A method according to claim 8, wherein each substructural element exhibit a cell header, said cell header storing a channel identifier for designating an association of said each substructural element with a communication terminal, said cell header further storing a length indicator for specifying a number of payload segments transmitted in said each substructural element.

12. A method according to claim 8, wherein said substructural elements are structured according to an ATM data format in accordance with a convention known as Second ATM adaption layer.

13. A method according to claim 10, further comprising the step of:
arranging said data transmission and said substructural elements in a payload area of an Internet Protocol data packet such that a substructural element begins in a segment defined as a first payload segment of the Internet Protocol data packet.

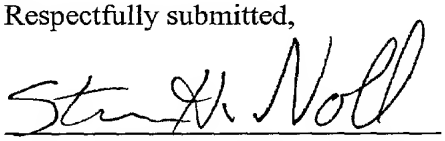
14. A method according to claim 13, further comprising the step of:

defining a pointer in said first payload segment for designating a start address of a first substructural element segment, said first substructural element located in the payload area of the Internet Protocol data packet.

REMARKS

The foregoing amendments to the specification and claims under Article 41 of the Patent Cooperation Treaty place the application into a form for prosecution before the U.S. Patent and Trademark Office under 35 U.S.C. §371. Accordingly, entry of these amendments before examination on the merits is hereby requested.

Respectfully submitted,



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ATTORNEY FOR APPLICANT

BOX PCT
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

REQUEST FOR APPROVAL OF DRAWING CHANGES

APPLICANT(S):	Wolfgang FRAAS et al.
ATTORNEY DOCKET NO.:	P01,0047
INTERNATIONAL APPLICATION NO:	PCT/DE99/03056
INTERNATIONAL FILING DATE:	23 September 1999
INVENTION:	METHOD FOR CONNECTING TERMINALS TO A EXCHANGE VIA A COMMUNICATIONS NETWORK

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Enclosed are three sheets of drawings showing in red, changes to Figures 1-3. Approval of the changes is respectfully requested.

Submitted by,

Steven H. Noll (Reg. No. 28,982)

Steven H. Noll
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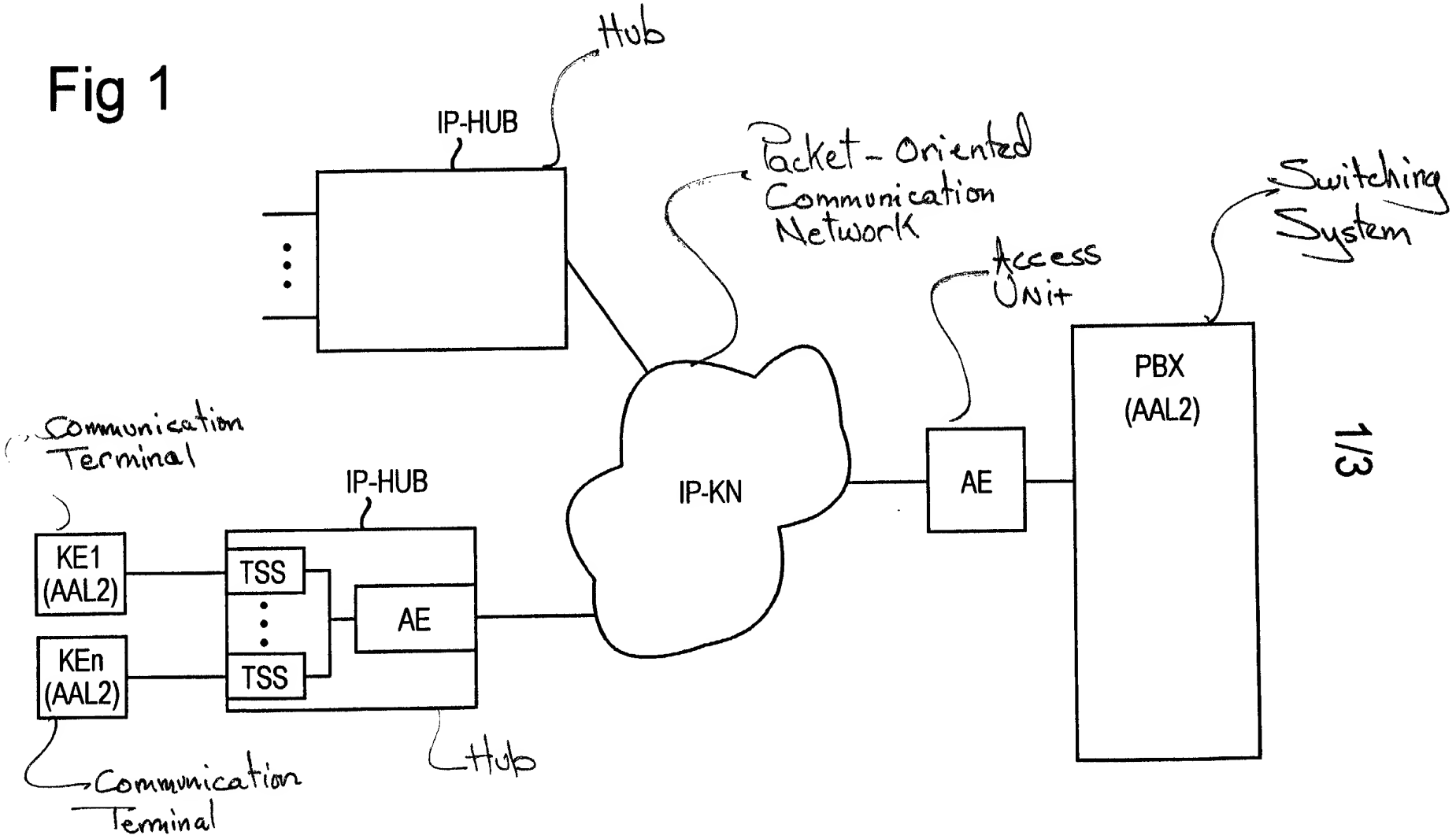
Attorney for Applicant(s)

CUSTOMER NUMBER 26574

Fig 1



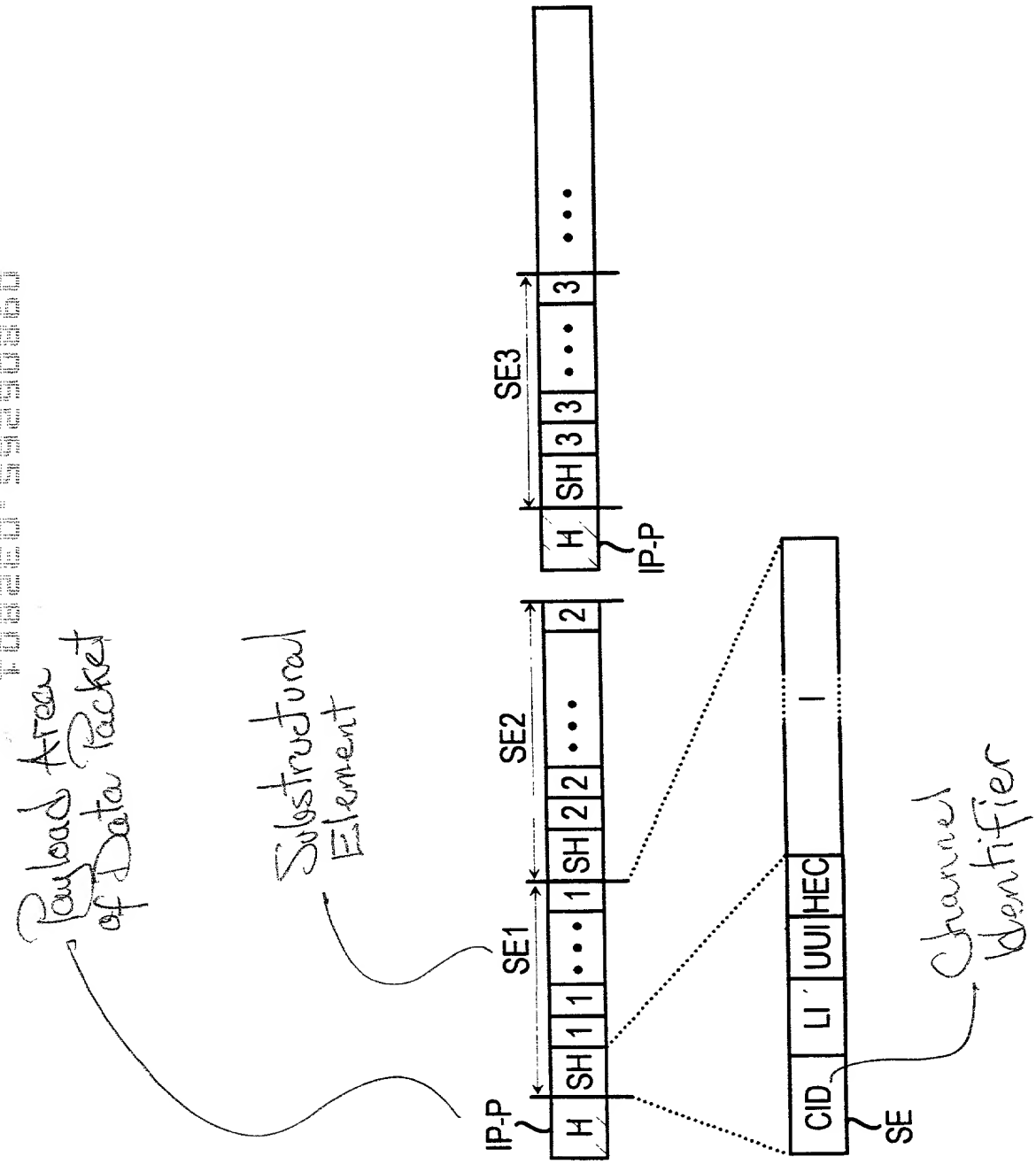

Payload Area of Data Packet
Substructual Element
SE1
SE2
SE3
IP-P
IP-P
H
SH
1
2
3
CID
LI
UUI
HEC
I
SE
Channel Identifier

Fig 2

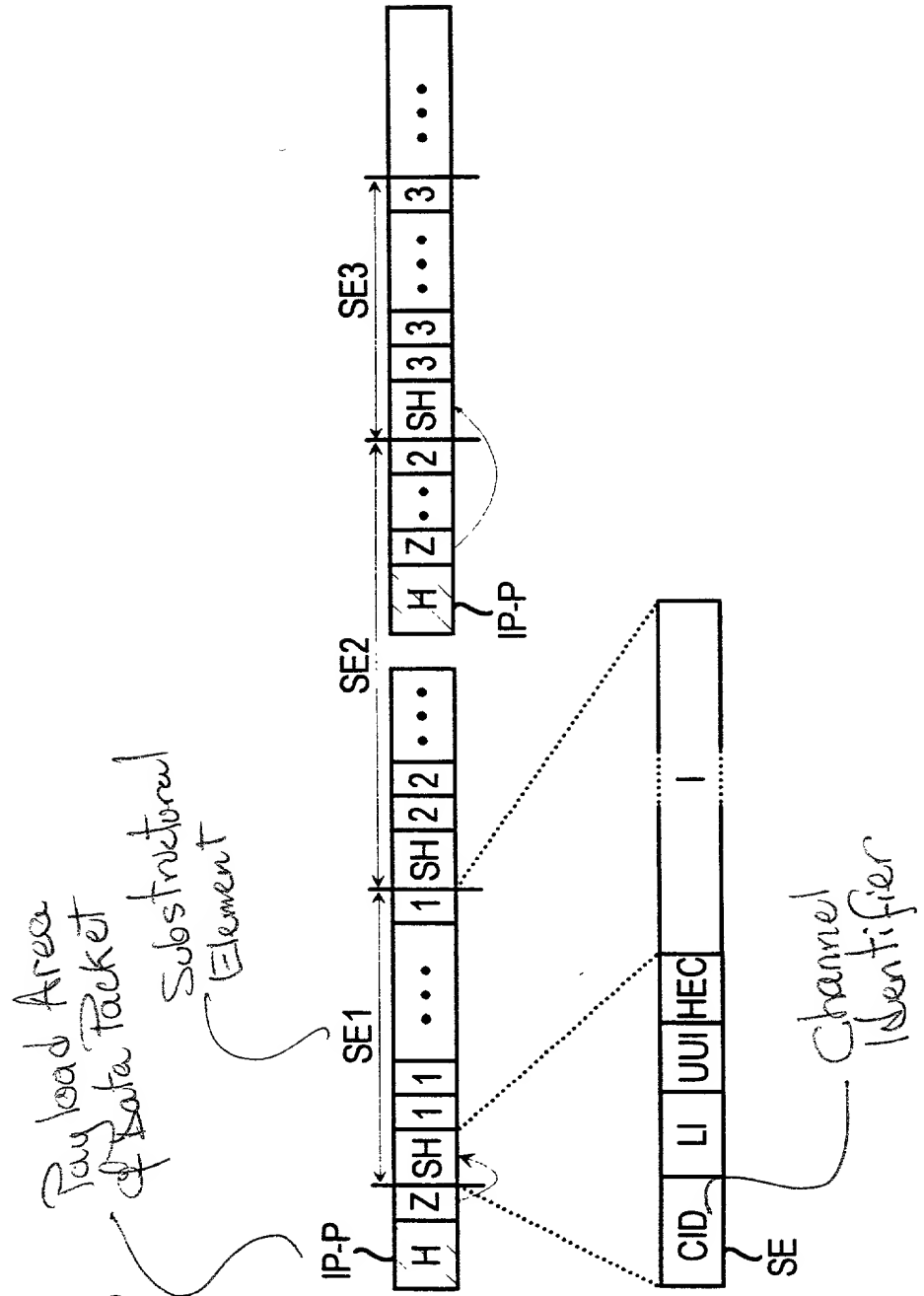

Payload Area of Data Packet
Substructural Element
SE1
SE2
SE3
IP-P
IP-P
H
Z
SH
1
2
3
...
CID
LI
UUI
HEC
I
SE
Channel Identifier

Fig 3

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IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

SUBMISSION OF DRAWINGS FOR PUBLICATION

APPLICANT(S):	Wolfgang FRAAS et al.
ATTORNEY DOCKET NO.:	P01,0047
INTERNATIONAL APPLICATION NO:	PCT/DE99/03056
INTERNATIONAL FILING DATE:	23 September 1999
INVENTION:	METHOD FOR CONNECTING TERMINALS TO A EXCHANGE VIA A COMMUNICATIONS NETWORK

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Enclosed are three sheets of drawings for publication, showing Figures 1-3, for the above-identified PCT application.

Submitted by,

Steven H. Noll (Reg. No. 28,982)

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CUSTOMER NUMBER 26574

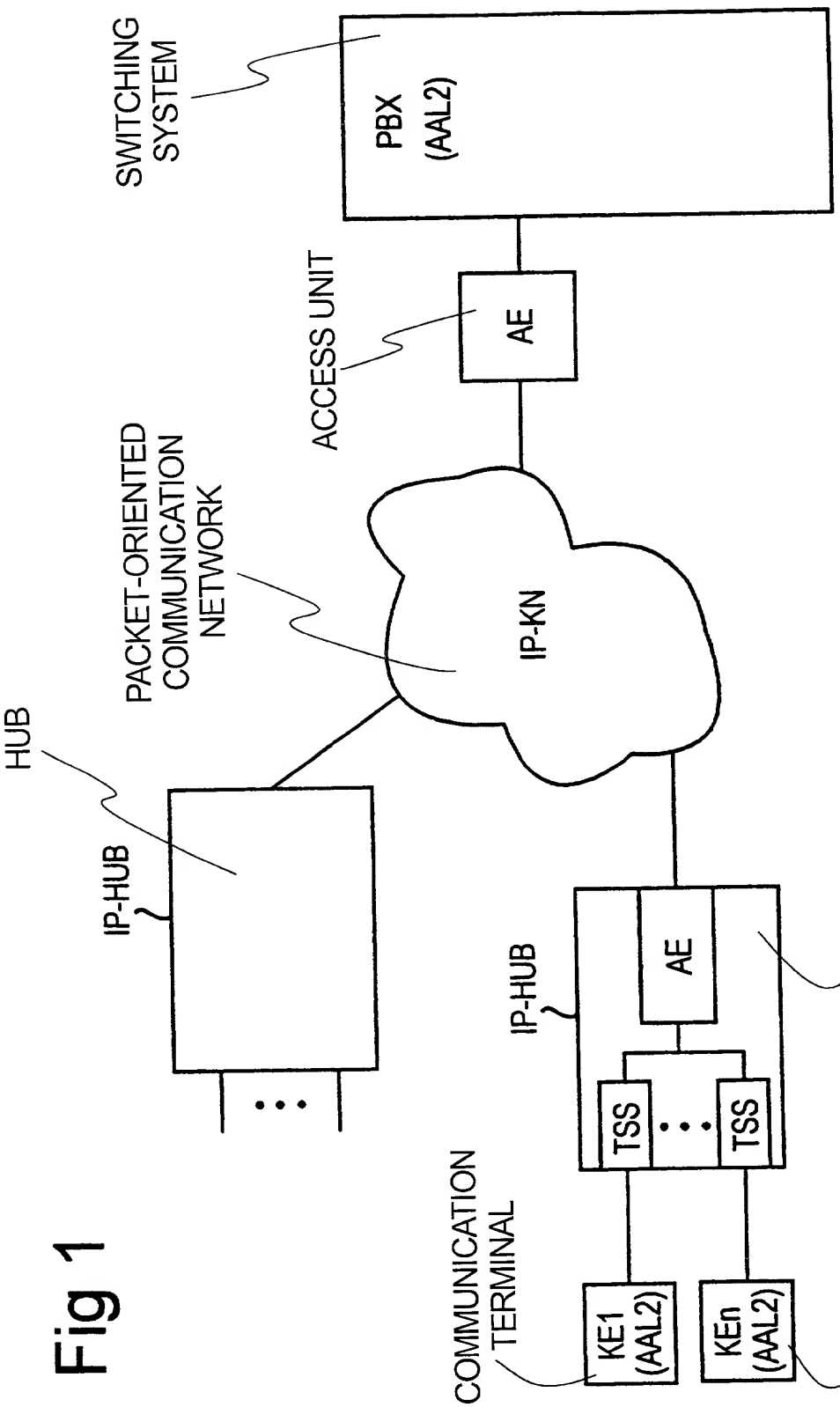

SWITCHING SYSTEM
PBX (AAL2)
ACCESS UNIT
AE
PACKET-ORIENTED COMMUNICATION NETWORK
IP-KN
HUB
IP-HUB
IP-HUB
AE
HUB
TSS
TSS
COMMUNICATION TERMINAL
KE1 (AAL2)
KEn (AAL2)
COMMUNICATION TERMINAL

Fig 1

Fig 2

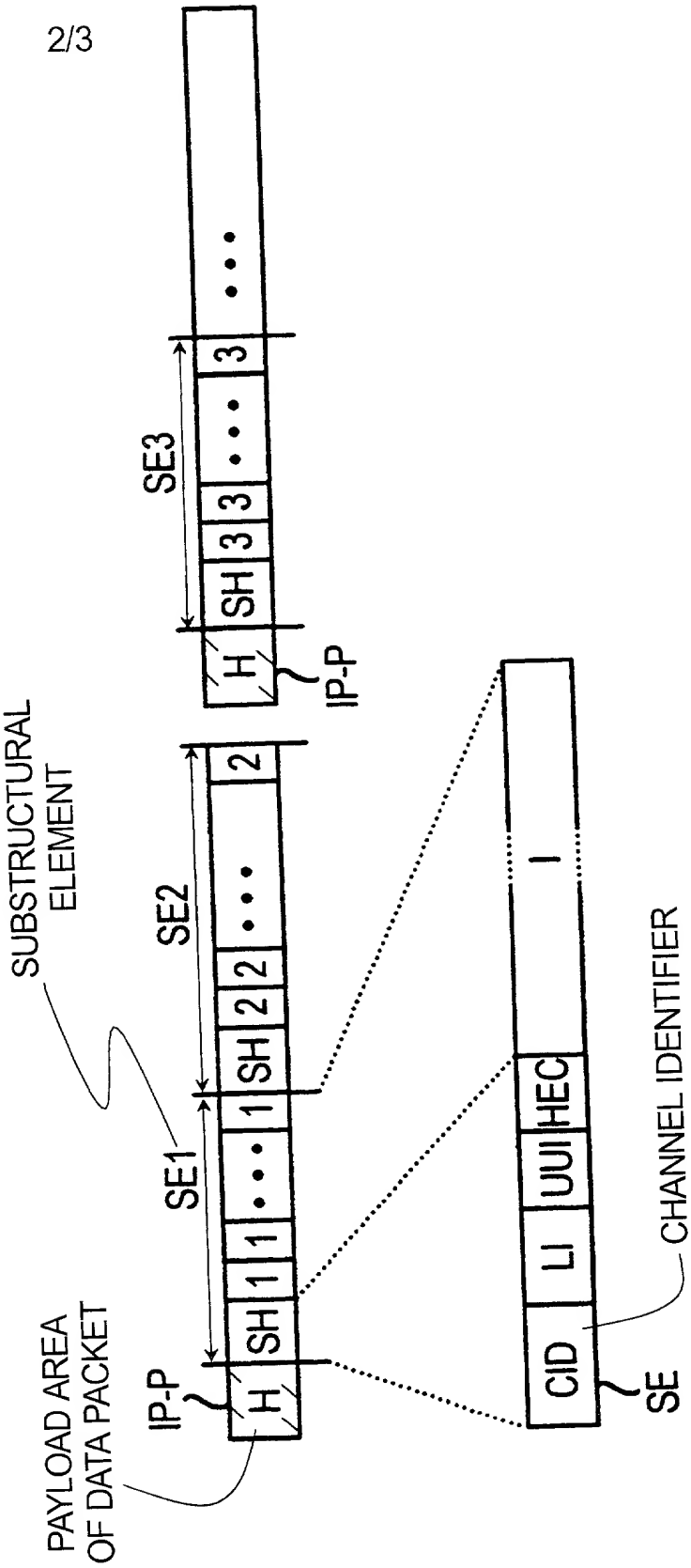
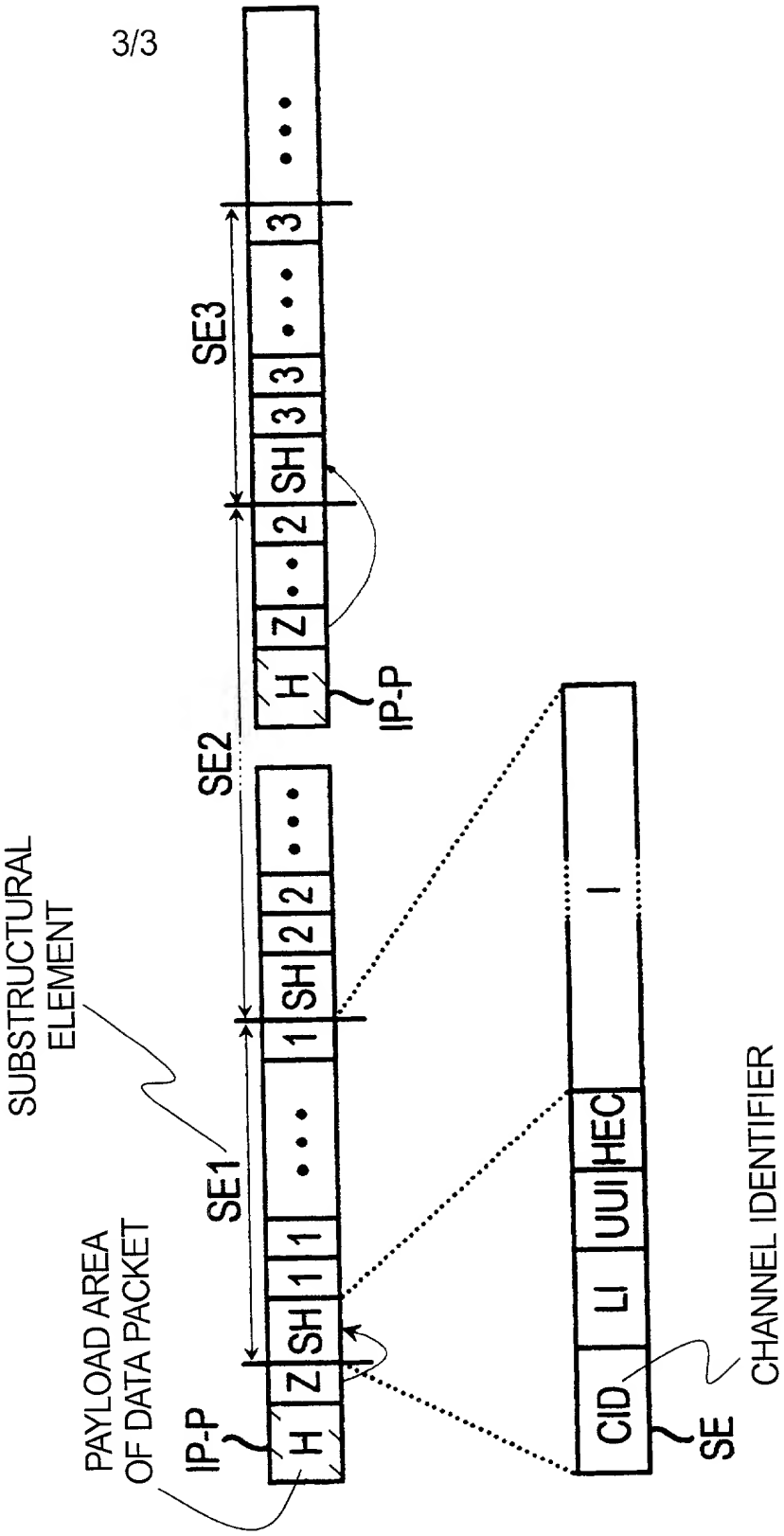

SUBSTRUCTURAL ELEMENT
PAYLOAD AREA OF DATA PACKET
IP-P
SE1
SE2
SE3
H
SH
1
2
3
CID
LI
UUI
HEC
I
SE
CHANNEL IDENTIFIER

Fig 3


SUBSTRUCTURAL ELEMENT
PAYLOAD AREA OF DATA PACKET
IP-P
SE1
SE2
SE3
H
Z
SH
1
2
3
LI
UUI
HEC
CID
SE
CHANNEL IDENTIFIER

~~[1~~

~~GR 98 P 2841~~

~~1~~

~~GR 98 P 2841~~

~~Description~~

~~Method]~~ **S P E C I F I C A T I O N**

TITLE

METHOD FOR CONNECTING COMMUNICATION TERMINALS TO A SWITCHING SYSTEM VIA A COMMUNICATION NETWORK

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is directed to a method for connecting communication terminals to a switching system ~~[via a communication network]~~**.**

~~[There is in]~~ Description of the Related Art

In modern communication technology**, there exists** an ever-increasing demand for broadband transmission of information such as, ~~[for example, of]~~ still and moving pictures in video telephone applications ~~[or, respectively,]~~ **and** of large volumes of data on the ~~[so-called]~~ Internet. As a result, the significance of transmission technologies for high or variable data transmission rates (greater than 100 MBit/s) which take into account both the requirements of the data transmission (high speed at variable transmission bit rate) and the requirements of voice data transmission (maintenance of time correlations in the case of a data transmission by a communication network) is increasing. The ~~[so-called]~~ asynchronous transfer mode (ATM) is a known data

transmission method for high data speeds which additionally meets the requirements of voice data transmission.

This requires, in particular, broadband data transmission right up to the communication end point area, i.e. from the transmitting communication terminal to the receiving communication terminal that is frequently called end-to-end transmission in the literature. The consequence is that the number of ~~[so-called]~~ ATM-capable communication terminals, i.e. of communication terminals which support the ATM data format for a transmission of data between communication terminals and the switching system associated with the communication terminal, rises ~~[steeply]~~ **drastically**.

If such ATM-capable communication terminals are connected to a switching system not directly but via a non-ATM-oriented communication network, (for example due to a large distance between the communication terminal and the switching system associated with the [ ]communication terminal,) the ATM data format must be converted to the data format of the communication network [ ]before any transmission of data via the communication network **takes place**. If this communication network is a data network which frequently already exists in companies and in which, preferably, Internet protocols (IPs) are used such as, for example, the ~~[so-called ?]~~ "Ethernet~~[?]~~" or the ~~[so-called ?]~~ "Tokenring~~[?]~~", the transmission of data to be transmitted in a voice call will take place via such an IP-oriented communication network in accordance with the Realtime Transport Protocol (RTP) according to ITU-T (International Telecommunication Union) Standard H.225.0.

If compressed voice data are transmitted - as used, for example, in mobile radio - these compressed voice data must be decompressed at the transmitter end before they are transmitted via the IP-oriented communication network, converted into the IP data format according to the RTP protocol and then recompressed for the transmission. Furthermore, the data must be decompressed at the receiver end, converted into the original data format and then recompressed for the further transmission. This frequent compression/decompression of the voice data leads to a corruption at the receiver end of the voice data originally transmitted which may be audible and can thus be sensed to be disturbing.

It is the object of the following invention to specify a method by means of which voice data transmission via an IP-oriented computer network is made possible without loss of voice quality.

~~[According to the invention, the object is achieved by means of the features of claims 1 and 2, respectively.~~

]To provide a better understanding of a data transmission between an ATM-capable communication terminal and a switching system associated with the communication terminal, it appears to be [

]necessary first of all to discuss known principles again in greater detail.

A data transmission between an ATM-capable communication terminal and a switching system associated with the communication terminal - frequently called Home PBX of the communication terminal in the literature - usually takes place on the basis of so-called CPS (Common Part Sublayer) packets - ~~[called]~~ **referred to as**

substructural elements SE in the **following** text ~~[which follows]~~- according to the so-called ATM adaptation layer AAL-Typ2. In this arrangement, the ATM adaptation layer AAL provides an adaptation between the format of the ATM layer (layer 2) and the network layer (layer 3) of the OSI (Open System Interconnection) reference model.

A substructural element SE is composed of a 3-byte-long cell header SH and a payload area I of variable length (0 to 64 bytes). The cell header of a substructural element SE, in turn, is subdivided into an 8-bit-long channel identifier CID, a 6-bit-long length indicator LI, a 5-bit-long user-to-user indication UUI and a 5-bit-long cell header error control HEC.

SUMMARY OF THE INVENTION

A significant advantage of the method according to the **present** invention consists in that the data packed into substructural elements can be transmitted transparently, i.e. without processing via the IP-oriented communication network and there is thus no compression/decompression and conversion according to the RTP protocol at the transmitter and receiver end.

A further advantage of the method according to the invention consists in that, by substructuring the data packets set up for a data transmission via the IP-oriented communication network into ~~[so-called]~~ **the** substructural elements, {

}data allocated to different communication terminals can be transmitted within a data packet.

{

~~Advantageous further developments of the invention are specified in the subclaims. An advantage of embodiments of the invention defined in the subclaims consists, among other things, in that~~] **Furthermore, the present invention,** due to the transmission of an individually adjustable number of payload bytes associated with a voice link in a substructural element of a data packet, **is capable of** a data transmission with a variable transmission rate ~~[can be implemented]~~. This makes it possible to use compression algorithms which generate a variable datastream without corruption of the information, from a continuous datastream in dependence on the redundancy existing in the data to be transmitted.

~~[A further advantage of embodiments of the invention defined in the subclaims consists in that]~~ **In addition,** due to the definition of the first payload segment of a data packet as a pointer which designates the start address of a first substructural element located in the payload area of the data packet, **by implementing the present invention** it is possible to synchronize transmitter and receiver in a simple manner when one or more data packets are lost.

~~[In the text which follows, an exemplary embodiment of the invention will be explained in greater detail with reference to the drawing, in which:]~~ **BRIEF DESCRIPTION OF THE DRAWINGS**

~~[Figure 1:]~~ **Figure 1** shows a structure diagram for the diagrammatic representation of communication terminals connected to a switching system via an IP-oriented communication network~~[;]~~.

Figure 2 ~~[:]~~ shows a structure diagram for the diagrammatic representation of IP data packets subdivided into substructural elements in accordance with a first conversion mode~~[;]~~.

Figure 3 ~~[:]~~ shows a structure diagram for the diagrammatic representation of IP data packets subdivided into substructural elements in accordance with a second conversion mode.

~~[Figure 1 shows a diagrammatic representation of a switching system PBX (Private Branch Exchange) which is connected to an IP (Internet Protocol) oriented communication network IP-KN via an access unit AE.]~~ **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

Examples of data networks in which IP protocols are preferably used are the ~~[so-called ?Ethernet?]~~ **'Ethernet'** according to IEEE (Institute of Electrical and Electronic Engineers) Standard 802.3 or the ~~[so-called ?Tokenring?]~~ **'Tokenring'** according to IEEE Standard 802.5. Furthermore, IP HUBs IP-HUB - frequently called ~~[?Hub?]~~ **'Hub'** in the literature - are connected to the IP-oriented communication network IP-KN. The IP hubs are connected to the IP-oriented communication network IP-KN via further access units AE. The IP hubs IP-HUB additionally have subscriber

interfaces TSS for connecting communication terminals to the IP-oriented communication network IP-KN. Communication terminals KE1,~~[?]~~ ...,KEn, which are connected to an IP hub IP-HUB via the subscriber interfaces TSS are shown by way of example.

A data transmission between the communication terminals KE1,~~[?]~~ ...,KEn and the switching system PBX usually takes place on the basis of substructural elements SE according to the ~~[so-called]~~ ATM adaptation layer AAL-Typ2. For a data transmission between the communication terminals KE1,~~[?]~~ ...,KEn and a switching system PBX via the IP-oriented communication network IP-KN, a bi-directional conversion takes place between the data format formed from substructural elements SE and the data format of the IP-oriented communication network IP-KN due to the access units AE ~~[~~

~~]~~in accordance with two different conversion modes which ~~[will be]~~ **are** explained in greater detail below.

Figure 2 shows a diagrammatic representation of IP data packets IP-P, subdivided into substructural elements SE, according to a first conversion mode. An IP data packet IP-P is composed of a packet header H and a payload field with a variable length of 1 - 65536 bytes. In the packet header H, switching data such as, for example, the destination address and the original address of an IP data packet IP-P are essentially stored.

A substructural element SE is composed of a 3-byte-long cell header SH and a payload area I of variable length (0 to 64 bytes). The cell header of a substructural

element SE, in turn, is subdivided into an 8-bit-long channel identifier CID, a 6-bit-long length indicator LI, a 5-bit-long user-to-user indication UUI and a 5-bit-long cell header HEC. The channel identifier CID provides a possibility of allocating a substructural element SE to a certain connection via the IP-oriented communication network IP-KN and thus to transmit data associated with different communication terminals KE1,~~[?]~~ ...,KEn in an IP data packet. The length indicator LI provides a possibility of defining a payload area I of variable length so that a voice connection between a communication terminal KE1,~~[?]~~ ...,KEn and the switching system PBX can be implemented with variable transmission bit rate. This enables compression algorithms which generate a variable datastream without corruption of the information from a continuous datastream in dependence on the redundancy existing in the data to be transmitted, to be used in the communication terminals KE1,~~[?]~~ ...,KEn.

According to the first conversion mode, the substructural elements SE are inserted into the payload field of an IP data packet IP-P in such a manner that the first byte of the payload field is occupied by a cell header SH of a substructural element SE and the last byte of the payload field ends with the last byte of a substructural element SE. This means that the length of the payload field of an IP data packet IP-P is selected in such a manner that one or more substructural elements SE are transmitted completely in an IP data packet IP-P. By way of example, two substructural elements SE1, SE2 are transmitted completely in a first IP data packet IP-P and one substructural element SE3 is transmitted in a second IP data packet IP-P in the figure.

In the case where one or more IP data packets IP-P have been lost, for example due to a transmission error, a synchronization between transmitter and receiver is possible by means of the length indicator LI of the first substructural element SE transmitted in the payload field of an IP data packet IP-P since the position of any further substructural elements SE which may be arranged in the payload field can be determined from this length indicator LI.

Figure 3 shows a diagrammatic representation of IP data packets IP-P subdivided into substructural elements SE according to a second conversion mode. According to the second conversion mode, substructural elements SE can also be distributed over payload fields of a number of IP data packets IP-P. Shown by way of example for the substructural element SE2 in the figure. The consequence of this is that it is no longer mandatory that the payload field of an IP data packet IP-P must begin with a cell header SH of a substructural element SE so that, when one or more IP data packets are lost, synchronization of transmitter and receiver by means of the length indicator LI of a substructural element SE is no longer possible.

For this purpose, the first byte of the payload field of an IP data packet IP-P is defined as pointer Z. Thus, the substructural elements SE are only transmitted with the second byte of the payload field of an IP data packet IP-P. This pointer Z specifies the start address of the first substructural element SE, the cell header SH of which is located in the payload field of an IP data packet IP-P. This pointer Z can thus be used for restoring the synchronization between transmitter and receiver.

During a data transmission from a communication terminal KE1,~~[?]~~ ...,KEn to the switching system PBX, the data to be transmitted are transmitted by the communication terminal KE1,~~[?]~~ ...,KEn in the form of substructural elements SE to the IP hub IP-HUB associated with the communication terminal KE1,~~[?]~~ ...,KEn. The substructural elements SE are inserted into data packets IP-P in accordance with the first or second conversion mode, ~~[respectively,]~~ in the access unit AE of the IP hub IP-HUB, the data packets IP-P exhibiting the IP address of the access unit AE associated with the switching system PBX in the packet header H. After that, the data packets IP-P are transmitted via the IP-oriented communication network IP-KN to the access unit AE associated with the switching system PBX. This access unit AE extracts the substructural elements SE contained in the received data packets IP-P and forwards the extracted substructural elements SE to the switching system PBX.

During a data transmission from the switching system PBX to a communication terminal KE1,~~[?]~~ ...,KEn, the data to be transmitted are transmitted by the switching system PBX in the form of substructural elements SE to the access unit AE associated with the switching system PBX. In the access unit AE, the substructural elements SE are inserted into data packets IP-P in accordance ~~[~~ ~~]~~with the first or, ~~[respectively,]~~ second conversion mode, the data packets IP-P exhibiting in the packet header H the IP address of the IP hub IP-HUB associated with the ~~[~~ ~~]~~communication terminal KE1,~~[?]~~ ...,KEn. The data packets IP-P are then transmitted via the IP-oriented communication network IP-KN to the IP hub IP-HUB addressed. In

the access unit AE of the IP hub IP-HUB, the substructural elements SE contained in the received data packets IP-P are extracted and forwarded to the corresponding communication terminal KE1,~~[?]~~ ...,KEn by means of the channel identifier CID stored in the substructural elements SE.

Due to the transmission of data combined in the substructural elements SE in accordance with the ATM adaptation layer AAL-Typ2 via the IP-oriented communication network IP-KN, there is no bi-directional conversion between the data format structured into substructural elements SE and the RTP data format normally used for transmitting voice data via the IP-oriented communication network IP-KN. In addition, the associated compression/decompression of the data does not take place either. Thus, an end-to-end transmission of voice data based on substructural elements SE via an IP-oriented communication network IP-KN is possible without loss of voice quality due to multiple compression and decompression of the voice data to be transmitted since the voice data are transmitted transparently, i.e. without processing in the substructural elements SE via the IP-oriented communication network IP-KN.

~~[Abstract]~~ **Although other modifications and changes may be suggested by those skilled in the art, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications as reasonably and properly come within the scope of their contribution to the art.**

~~[Method for connecting communication terminals to a switching system via a communication network]~~ **ABSTRACT OF DISCLOSURE**

The communication terminals ~~[(KE1,?,KEn)]~~ are connected to the packet-oriented communication network ~~[(IP-KN)]~~ via a hub ~~[(IP-HUB)]~~ and the switching system ~~[(PBX)]~~ is connected to the packet-oriented communication network ~~[(IP-KN)]~~ via an access unit~~[(AE)]~~. A data format formed of substructural elements ~~[(SE)]~~ is set up for a data transmission between a switching system ~~[(PBX)]~~ and the communication terminals~~[(KE1,?,KEn)]~~. The data to be transmitted in the form of substructural elements ~~[(SE)]~~ are inserted into data packets ~~[(IP-P)]~~ at the transmitter end for a data transmission via the communication network~~[(IP-KN)]~~. The substructural elements ~~[(SE)]~~ are extracted from the received data packets ~~[(IP-P)]~~ at the receiver end. **Accordingly, the data packets have been transmitted transparently with no compression/decompression and conversion according to the RTP protocol at the transmitter and receiver end.** ~~[Figure 1]~~

---------- REVISION LIST ----------

The bracketed numbers refer to the Page and Paragraph for the **start** of the paragraph in both the **old** and the **new** documents.

[1:1 1:1] Del Paras "1 ... Description"

[1:6 1:1] Add Paras "S P E C I F I C ... of the Invention"

[1:6 1:6] Changed "Method " **to** "The present ... a method "

[1:6 1:6] Changed "via a communication network" **to** "."

[1:7 1:7] Add Para "Description of the Related Art"

[1:7 1:8] Changed "There is in " **to** "In "

[1:7 1:8] Changed "technology an" **to** "technology, ... exists an"

[1:7 1:8] Changed "as, for example, of still" **to** "as, still"

[1:7 1:8] Changed "or, respectively, " **to** "and "

[1:7 1:8] Changed "the so-called Internet." **to** "the Internet."

[1:7 1:8] Changed "The so-called asynchronous" **to** "The asynchronous"

[1:8 1:9] Changed "of so-called ATM-capable" **to** "of ATM-capable"

[1:8 1:9] Changed "steeply" **to** "drastically"

[2:1 2:1] Changed "network, for" **to** "network, (for"

[3:1 2:1] Changed "terminal, the" **to** "terminal,) the"

[4:1 2:1] Changed "network." **to** "network takes place."

[4:1 2:1] Changed "the so-called ?Ethernet?" **to** "the “Ethernet”"

[4:1 2:1] Changed "? " **to** "” "

[4:1 2:1] Changed "the so-called ?Tokenring?, " **to** "the “Tokenring”, "

[4:1 2:1] Changed "?Tokenring?," **to** "“Tokenring”,"

[4:4 3:2] Changed "According ... To" **to** "To"

[6:2 3:3] Changed "- called substructural" **to** "- referred ... substructural"

[6:2 3:3] Changed "the text which follows" **to** "the following text "

[6:4 4:1] Add Para "SUMMARY OF THE INVENTION"

[6:4 4:2] Changed "the invention" **to** "the present invention"

[6:5 4:3] Changed "so-called " **to** "the "

[7:1 4:4] Changed "packet." **to** ""

[7:2 4:4] Del Para "Advantageous further ... the subclaims."

[7:3 4:4] Changed "An advantage ... things, in that " **to** "Furthermore, ... invention, "

[7:3 4:4] Changed "packet, a" **to** "packet, is capable of a"

[7:3 4:4] Changed "rate can be implemented." **to** "rate."

[7:4 4:5] Changed "A further ... consists in that" **to** "In addition"

[7:4 4:5] Changed "packet, it" **to** "packet, by ... invention it"

[7:5 5:1] Changed "In the text ... in which:" **to** "BRIEF DESCRIPTION OF THE DRAWINGS"

[7:6 5:2] Changed "Figure 1: " **to** "Figure 1 "

[7:6 5:2] Changed ";" **to** "."

[8:1 5:3] Changed "2: shows" **to** "2 shows"

[8:1 5:3] Changed ";" **to** "."

[8:2 5:4] Changed "3: shows" **to** "3 shows"

[8:3 5:5] Changed "Figure 1 shows ... unit AE. " **to** "DETAILED DESCRIPTION ... EMBODIMENT"

[8:3 5:6] Changed "so-called ?Ethernet? " **to** "'Ethernet' "

[8:3 5:6] Changed "so-called ?Tokenring? " **to** "'Tokenring' "

[8:3 5:6] Changed "?Hub? " **to** "'Hub' "

[8:3 5:6] Changed "KE1,?,KEn," **to** "KE1,...,KEn,"

[8:4 6:1] Changed "communication ... KE1,?,KEn and the" **to** "communication ... KE1,...,KEn and the"

[8:4 6:1] Changed "the so-called ATM" **to** "the ATM"

[8:4 6:1] Changed "communication ... KE1,?,KEn and a" **to** "communication ... KE1,...,KEn and a"

[9:1 6:1] Changed "will be " **to** "are "

[9:3 6:3] Changed "terminals KE1,?,KEn in" **to** "terminals KE1,...,KEn in"

[9:3 6:3] Changed "terminal KE1,?,KEn and" **to** "terminal KE1,...,KEn and"

[9:3 6:3] Changed "KE1,?,KEn." **to** "KE1,...,KEn."

[12:2 8:3] Changed"terminal KE1,?,KEn to" **to** "terminal KE1,...,KEn to"

[12:2 8:3] Changed"terminal KE1,?,KEn in" **to** "terminal KE1,...,KEn in"

[12:2 8:3] Changed"KE1,?,KEn." **to** "KE1,...,KEn."

[12:2 8:3] Changed"mode, respectively, in" **to** "mode, in"

[12:3 9:1] Changed"?" **to** "..."

[14:1 9:1] Changed"or, respectively, second" **to** "or, second"

[15:1 9:1] Changed"KE1,?,KEn." **to** "KE1,...,KEn."

[15:1 9:1] Changed"terminal KE1,?,KEn by" **to** "terminal KE1,...,KEn by"

[16:1 10:1] Changed "Abstract" **to** "Although other ... to the art."

[16:2 11:1] Changed "Method for ... communication network" **to** "ABSTRACT OF DISCLOSURE"

[16:3 11:2] Changed "terminals (KE1,?,KEn) are" **to** "terminals are"

[16:3 11:2] Changed "packet-oriented ... hub (IP-HUB)" **to** "packet-oriented ... via a hub "

[16:3 11:2] Changed "system (PBX) is" **to** "system is"

[16:3 11:2] Changed "communication ... (IP-KN) via an" **to** "communication network via an"

[16:3 11:2] Changed "unit (AE)." **to** "unit."

[16:3 11:2] Changed "elements (SE) is" **to** "elements is"

[16:3 11:2] Changed "system (PBX) and" **to** "system and"

[16:3 11:2] Changed "terminals (KE1,?,KEn)." **to** "terminals."

[16:3 11:2] Changed "substructural ... transmitter" **to** "substructural ... transmitter"

[16:3 11:2] Changed "network (IP-KN)." **to** "network."

[16:3 11:2] Changed "substructural ... extracted" **to** "substructural ... extracted"

[16:3 11:2] Changed "received data ... the receiver" **to** "received data ... the receiver"

[16:4 11:2] Changed "Figure 1" **to** "Accordingly, ... receiver end."

SPECIFICATION

TITLE

METHOD FOR CONNECTING COMMUNICATION TERMINALS TO A SWITCHING SYSTEM VIA A COMMUNICATION NETWORK

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is directed to a method for connecting communication terminals to a switching system.

Description of the Related Art

In modern communication technology, there exists an ever-increasing demand for broadband transmission of information such as, still and moving pictures in video telephone applications and of large volumes of data on the Internet. As a result, the significance of transmission technologies for high or variable data transmission rates (greater than 100 MBit/s) which take into account both the requirements of the data transmission (high speed at variable transmission bit rate) and the requirements of voice data transmission (maintenance of time correlations in the case of a data transmission by a communication network) is increasing. The asynchronous transfer mode (ATM) is a known data transmission method for high data speeds which additionally meets the requirements of voice data transmission.

This requires, in particular, broadband data transmission right up to the communication end point area, i.e. from the transmitting communication terminal to the receiving communication terminal that is frequently called end-to-end transmission in

the literature. The consequence is that the number of ATM-capable communication terminals, i.e. of communication terminals which support the ATM data format for a transmission of data between communication terminals and the switching system associated with the communication terminal, rises drastically.

If such ATM-capable communication terminals are connected to a switching system not directly but via a non-ATM-oriented communication network, (for example due to a large distance between the communication terminal and the switching system associated with the communication terminal,) the ATM data format must be converted to the data format of the communication network before any transmission of data via the communication network takes place. If this communication network is a data network which frequently already exists in companies and in which, preferably, Internet protocols (IPs) are used such as, for example, the "Ethernet" or the "Tokenring", the transmission of data to be transmitted in a voice call will take place via such an IP-oriented communication network in accordance with the Realtime Transport Protocol (RTP) according to ITU-T (International Telecommunication Union) Standard H.225.0.

If compressed voice data are transmitted - as used, for example, in mobile radio - these compressed voice data must be decompressed at the transmitter end before they are transmitted via the IP-oriented communication network, converted into the IP data format according to the RTP protocol and then recompressed for the transmission. Furthermore, the data must be decompressed at the receiver end, converted into the original data format and then recompressed for the further transmission. This frequent compression/decompression of the voice data leads to a corruption at the receiver end

of the voice data originally transmitted which may be audible and can thus be sensed to be disturbing.

It is the object of the following invention to specify a method by means of which voice data transmission via an IP-oriented computer network is made possible without loss of voice quality.

To provide a better understanding of a data transmission between an ATM-capable communication terminal and a switching system associated with the communication terminal, it appears to be necessary first of all to discuss known principles again in greater detail.

A data transmission between an ATM-capable communication terminal and a switching system associated with the communication terminal - frequently called Home PBX of the communication terminal in the literature - usually takes place on the basis of so-called CPS (Common Part Sublayer) packets - referred to as substructural elements SE in the following text - according to the so-called ATM adaptation layer AAL-Typ2. In this arrangement, the ATM adaptation layer AAL provides an adaptation between the format of the ATM layer (layer 2) and the network layer (layer 3) of the OSI (Open System Interconnection) reference model.

A substructural element SE is composed of a 3-byte-long cell header SH and a payload area I of variable length (0 to 64 bytes). The cell header of a substructural element SE, in turn, is subdivided into an 8-bit-long channel identifier CID, a 6-bit-long length indicator LI, a 5-bit-long user-to-user indication UUI and a 5-bit-long cell header error control HEC.

SUMMARY OF THE INVENTION

A significant advantage of the method according to the present invention consists in that the data packed into substructural elements can be transmitted transparently, i.e. without processing via the IP-oriented communication network and there is thus no compression/decompression and conversion according to the RTP protocol at the transmitter and receiver end.

A further advantage of the method according to the invention consists in that, by substructuring the data packets set up for a data transmission via the IP-oriented communication network into the substructural elements, data allocated to different communication terminals can be transmitted within a data packet.

Furthermore, the present invention, due to the transmission of an individually adjustable number of payload bytes associated with a voice link in a substructural element of a data packet, is capable of a data transmission with a variable transmission rate. This makes it possible to use compression algorithms which generate a variable datastream without corruption of the information, from a continuous datastream in dependence on the redundancy existing in the data to be transmitted.

In addition, due to the definition of the first payload segment of a data packet as a pointer which designates the start address of a first substructural element located in the payload area of the data packet, by implementing the present invention it is possible to synchronize transmitter and receiver in a simple manner when one or more data packets are lost.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a structure diagram for the diagrammatic representation of communication terminals connected to a switching system via an IP-oriented communication network.

Figure 2 shows a structure diagram for the diagrammatic representation of IP data packets subdivided into substructural elements in accordance with a first conversion mode.

Figure 3 shows a structure diagram for the diagrammatic representation of IP data packets subdivided into substructural elements in accordance with a second conversion mode.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Examples of data networks in which IP protocols are preferably used are the 'Ethernet' according to IEEE (Institute of Electrical and Electronic Engineers) Standard 802.3 or the 'Tokenring' according to IEEE Standard 802.5. Furthermore, IP HUBs IP-HUB - frequently called 'Hub' in the literature - are connected to the IP-oriented communication network IP-KN. The IP hubs are connected to the IP-oriented communication network IP-KN via further access units AE. The IP hubs IP-HUB additionally have subscriber interfaces TSS for connecting communication terminals to the IP-oriented communication network IP-KN. Communication terminals KE1,...,KEn, which are connected to an IP hub IP-HUB via the subscriber interfaces TSS are shown by way of example.

A data transmission between the communication terminals KE1,...,KEn and the switching system PBX usually takes place on the basis of substructural elements SE according to the ATM adaptation layer AAL-Typ2. For a data transmission between the communication terminals KE1,...,KEn and a switching system PBX via the IP-oriented communication network IP-KN, a bi-directional conversion takes place between the data format formed from substructural elements SE and the data format of the IP-oriented communication network IP-KN due to the access units AE in accordance with two different conversion modes which are explained in greater detail below.

Figure 2 shows a diagrammatic representation of IP data packets IP-P, subdivided into substructural elements SE, according to a first conversion mode. An IP data packet IP-P is composed of a packet header H and a payload field with a variable length of 1 - 65536 bytes. In the packet header H, switching data such as, for example, the destination address and the original address of an IP data packet IP-P are essentially stored.

A substructural element SE is composed of a 3-byte-long cell header SH and a payload area I of variable length (0 to 64 bytes). The cell header of a substructural element SE, in turn, is subdivided into an 8-bit-long channel identifier CID, a 6-bit-long length indicator LI, a 5-bit-long user-to-user indication UUI and a 5-bit-long cell header HEC. The channel identifier CID provides a possibility of allocating a substructural element SE to a certain connection via the IP-oriented communication network IP-KN and thus to transmit data associated with different communication terminals KE1,...,KEn in an IP data packet. The length indicator LI provides a possibility of

defining a payload area I of variable length so that a voice connection between a communication terminal KE1,...,KEn and the switching system PBX can be implemented with variable transmission bit rate. This enables compression algorithms which generate a variable datastream without corruption of the information from a continuous datastream in dependence on the redundancy existing in the data to be transmitted, to be used in the communication terminals KE1,...,KEn.

According to the first conversion mode, the substructural elements SE are inserted into the payload field of an IP data packet IP-P in such a manner that the first byte of the payload field is occupied by a cell header SH of a substructural element SE and the last byte of the payload field ends with the last byte of a substructural element SE. This means that the length of the payload field of an IP data packet IP-P is selected in such a manner that one or more substructural elements SE are transmitted completely in an IP data packet IP-P. By way of example, two substructural elements SE1, SE2 are transmitted completely in a first IP data packet IP-P and one substructural element SE3 is transmitted in a second IP data packet IP-P in the figure.

In the case where one or more IP data packets IP-P have been lost, for example due to a transmission error, a synchronization between transmitter and receiver is possible by means of the length indicator LI of the first substructural element SE transmitted in the payload field of an IP data packet IP-P since the position of any further substructural elements SE which may be arranged in the payload field can be determined from this length indicator LI.

Figure 3 shows a diagrammatic representation of IP data packets IP-P subdivided into substructural elements SE according to a second conversion mode. According to the second conversion mode, substructural elements SE can also be distributed over payload fields of a number of IP data packets IP-P. Shown by way of example for the substructural element SE2 in the figure. The consequence of this is that it is no longer mandatory that the payload field of an IP data packet IP-P must begin with a cell header SH of a substructural element SE so that, when one or more IP data packets are lost, synchronization of transmitter and receiver by means of the length indicator LI of a substructural element SE is no longer possible.

For this purpose, the first byte of the payload field of an IP data packet IP-P is defined as pointer Z. Thus, the substructural elements SE are only transmitted with the second byte of the payload field of an IP data packet IP-P. This pointer Z specifies the start address of the first substructural element SE, the cell header SH of which is located in the payload field of an IP data packet IP-P. This pointer Z can thus be used for restoring the synchronization between transmitter and receiver.

During a data transmission from a communication terminal KE1,...,KEn to the switching system PBX, the data to be transmitted are transmitted by the communication terminal KE1,...,KEn in the form of substructural elements SE to the IP hub IP-HUB associated with the communication terminal KE1,...,KEn. The substructural elements SE are inserted into data packets IP-P in accordance with the first or second conversion mode, in the access unit AE of the IP hub IP-HUB, the data packets IP-P exhibiting the IP address of the access unit AE associated with the switching system PBX in the

packet header H. After that, the data packets IP-P are transmitted via the IP-oriented communication network IP-KN to the access unit AE associated with the switching system PBX. This access unit AE extracts the substructural elements SE contained in the received data packets IP-P and forwards the extracted substructural elements SE to the switching system PBX.

During a data transmission from the switching system PBX to a communication terminal KE1,...,KEn, the data to be transmitted are transmitted by the switching system PBX in the form of substructural elements SE to the access unit AE associated with the switching system PBX. In the access unit AE, the substructural elements SE are inserted into data packets IP-P in accordance with the first or, second conversion mode, the data packets IP-P exhibiting in the packet header H the IP address of the IP hub IP-HUB associated with the communication terminal KE1,...,KEn. The data packets IP-P are then transmitted via the IP-oriented communication network IP-KN to the IP hub IP-HUB addressed. In the access unit AE of the IP hub IP-HUB, the substructural elements SE contained in the received data packets IP-P are extracted and forwarded to the corresponding communication terminal KE1,...,KEn by means of the channel identifier CID stored in the substructural elements SE.

Due to the transmission of data combined in the substructural elements SE in accordance with the ATM adaptation layer AAL-Typ2 via the IP-oriented communication network IP-KN, there is no bi-directional conversion between the data format structured into substructural elements SE and the RTP data format normally used for transmitting voice data via the IP-oriented communication network IP-KN. In addition, the associated

compression/decompression of the data does not take place either. Thus, an end-to-end transmission of voice data based on substructural elements SE via an IP-oriented communication network IP-KN is possible without loss of voice quality due to multiple compression and decompression of the voice data to be transmitted since the voice data are transmitted transparently, i.e. without processing in the substructural elements SE via the IP-oriented communication network IP-KN.

Although other modifications and changes may be suggested by those skilled in the art, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications as reasonably and properly come within the scope of their contribution to the art.

Description

Method for connecting communication terminals to a switching system via a communication network

There is in modern communication technology an ever-increasing demand for broadband transmission of information such as, for example, of still and moving pictures in video telephone applications or, respectively, of large volumes of data on the so-called Internet. As a result, the significance of transmission technologies for high or variable data transmission rates (greater than 100 MBit/s) which take into account both the requirements of the data transmission (high speed at variable transmission bit rate) and the requirements of voice data transmission (maintenance of time correlations in the case of a data transmission by a communication network) is increasing. The so-called asynchronous transfer mode (ATM) is a known data transmission method for high data speeds which additionally meets the requirements of voice data transmission.

This requires, in particular, broadband data transmission right up to the communication end point area, i.e. from the transmitting communication terminal to the receiving communication terminal that is frequently called end-to-end transmission in the literature. The consequence is that the number of so-called ATM-capable communication terminals, i.e. of communication terminals which support the ATM data format for a transmission of data between communication terminals and the switching system associated with the communication terminal, rises steeply.

If such ATM-capable communication terminals are connected to a switching system not directly but via a non-ATM-oriented communication network, for example due to a large distance between the communication terminal and the switching system associated with the

communication terminal, the ATM data format must be converted to the data format of the communication network

before any transmission of data via the communication network. If this communication network is a data network which frequently already exists in companies and in which, preferably, Internet protocols (IPs) are used such as, for example, the so-called "Ethernet" or the so-called "Tokenring", the transmission of data to be transmitted in a voice call will take place via such an IP-oriented communication network in accordance with the Realtime Transport Protocol (RTP) according to ITU-T (International Telecommunication Union) Standard H.225.0.

If compressed voice data are transmitted - as used, for example, in mobile radio - these compressed voice data must be decompressed at the transmitter end before they are transmitted via the IP-oriented communication network, converted into the IP data format according to the RTP protocol and then recompressed for the transmission. Furthermore, the data must be decompressed at the receiver end, converted into the original data format and then recompressed for the further transmission. This frequent compression/decompression of the voice data leads to a corruption at the receiver end of the voice data originally transmitted which may be audible and can thus be sensed to be disturbing.

It is the object of the following invention to specify a method by means of which voice data transmission via an IP-oriented computer network is made possible without loss of voice quality.

According to the invention, the object is achieved by means of the features of claims 1 and 2, respectively.

To provide a better understanding of a data transmission between an ATM-capable communication terminal and a switching system associated with the communication terminal, it appears to be

necessary first of all to discuss known principles again in greater detail.

A data transmission between an ATM-capable communication terminal and a switching system associated with the communication terminal - frequently called Home PBX of the communication terminal in the literature - usually takes place on the basis of so-called CPS (Common Part Sublayer) packets - called substructural elements SE in the text which follows - according to the so-called ATM adaptation layer AAL-Typ2. In this arrangement, the ATM adaptation layer AAL provides an adaptation between the format of the ATM layer (layer 2) and the network layer (layer 3) of the OSI (Open System Interconnection) reference model.

A substructural element SE is composed of a 3-byte-long cell header SH and a payload area I of variable length (0 to 64 bytes). The cell header of a substructural element SE, in turn, is subdivided into an 8-bit-long channel identifier CID, a 6-bit-long length indicator LI, a 5-bit-long user-to-user indication UUI and a 5-bit-long cell header error control HEC.

A significant advantage of the method according to the invention consists in that the data packed into substructural elements can be transmitted transparently, i.e. without processing via the IP-oriented communication network and there is thus no compression/decompression and conversion according to the RTP protocol at the transmitter and receiver end.

A further advantage of the method according to the invention consists in that, by substructuring the data packets set up for a data transmission via the IP-oriented communication network into so-called substructural elements,

data allocated to different communication terminals can be transmitted within a data packet.

Advantageous further developments of the invention are specified in the subclaims.

An advantage of embodiments of the invention defined in the subclaims consists, among other things, in that due to the transmission of an individually adjustable number of payload bytes associated with a voice link in a substructural element of a data packet, a data transmission with a variable transmission rate can be implemented. This makes it possible to use compression algorithms which generate a variable datastream without corruption of the information, from a continuous datastream in dependence on the redundancy existing in the data to be transmitted.

A further advantage of embodiments of the invention defined in the subclaims consists in that, due to the definition of the first payload segment of a data packet as a pointer which designates the start address of a first substructural element located in the payload area of the data packet, it is possible to synchronize transmitter and receiver in a simple manner when one or more data packets are lost.

In the text which follows, an exemplary embodiment of the invention will be explained in greater detail with reference to the drawing, in which:

Figure 1: shows a structure diagram for the diagrammatic representation of communication terminals connected to a switching system via an IP-oriented communication network;

Figure 2: shows a structure diagram for the diagrammatic representation of IP data packets subdivided into substructural elements in accordance with a first conversion mode;

Figure 3: shows a structure diagram for the diagrammatic representation of IP data packets subdivided into substructural elements in accordance with a second conversion mode.

Figure 1 shows a diagrammatic representation of a switching system PBX (Private Branch Exchange) which is connected to an IP (Internet Protocol) oriented communication network IP-KN via an access unit AE. Examples of data networks in which IP protocols are preferably used are the so-called 'Ethernet' according to IEEE (Institute of Electrical and Electronic Engineers) Standard 802.3 or the so-called 'Tokenring' according to IEEE Standard 802.5. Furthermore, IP HUBs IP-HUB - frequently called 'Hub' in the literature - are connected to the IP-oriented communication network IP-KN. The IP hubs are connected to the IP-oriented communication network IP-KN via further access units AE. The IP hubs IP-HUB additionally have subscriber interfaces TSS for connecting communication terminals to the IP-oriented communication network IP-KN. Communication terminals KE1,...,KEn, which are connected to an IP hub IP-HUB via the subscriber interfaces TSS are shown by way of example.

A data transmission between the communication terminals KE1,...,KEn and the switching system PBX usually takes place on the basis of substructural elements SE according to the so-called ATM adaptation layer AAL-Typ2. For a data transmission between the communication terminals KE1,...,KEn and a switching system PBX via the IP-oriented communication network IP-KN, a bi-directional conversion takes place between the data format formed from substructural elements SE and the data format of the IP-oriented communication network IP-KN due to the access units AE

in accordance with two different conversion modes which will be explained in greater detail below.

Figure 2 shows a diagrammatic representation of IP data packets IP-P, subdivided into substructural elements SE, according to a first conversion mode. An IP data packet IP-P is composed of a packet header H and a payload field with a variable length of 1 - 65536 bytes. In the packet header H, switching data such as, for example, the destination address and the original address of an IP data packet IP-P are essentially stored.

A substructural element SE is composed of a 3-byte-long cell header SH and a payload area I of variable length (0 to 64 bytes). The cell header of a substructural element SE, in turn, is subdivided into an 8-bit-long channel identifier CID, a 6-bit-long length indicator LI, a 5-bit-long user-to-user indication UUI and a 5-bit-long cell header HEC. The channel identifier CID provides a possibility of allocating a substructural element SE to a certain connection via the IP-oriented communication network IP-KN and thus to transmit data associated with different communication terminals KE1,...,KEn in an IP data packet. The length indicator LI provides a possibility of defining a payload area I of variable length so that a voice connection between a communication terminal KE1,...,KEn and the switching system PBX can be implemented with variable transmission bit rate. This enables compression algorithms which generate a variable datastream without corruption of the information from a continuous datastream in dependence on the redundancy existing in the data to be transmitted, to be used in the communication terminals KE1,...,KEn.

According to the first conversion mode, the substructural elements SE are inserted into the payload field of an IP data packet IP-P in such a manner that the first byte of the payload field is occupied by a cell header SH of a substructural element SE and the last byte of the payload field ends with the last byte of a substructural element SE. This means that the length of the payload field of an IP data packet IP-P is selected in such a manner that one or more substructural elements SE are transmitted completely in an IP data packet IP-P. By way of example, two substructural elements SE1, SE2 are transmitted completely in a first IP data packet IP-P and one substructural element SE3 is transmitted in a second IP data packet IP-P in the figure.

In the case where one or more IP data packets IP-P have been lost, for example due to a transmission error, a synchronization between transmitter and receiver is possible by means of the length indicator LI of the first substructural element SE transmitted in the payload field of an IP data packet IP-P since the position of any further substructural elements SE which may be arranged in the payload field can be determined from this length indicator LI.

Figure 3 shows a diagrammatic representation of IP data packets IP-P subdivided into substructural elements SE according to a second conversion mode. According to the second conversion mode, substructural elements SE can also be distributed over payload fields of a number of IP data packets IP-P. Shown by way of example for the substructural element SE2 in the figure. The consequence of this is that it is no longer mandatory that the payload field of an IP data packet IP-P must begin with a cell header SH of a substructural element SE so that, when one or more IP data packets are lost, synchronization of transmitter and receiver by means of the length indicator LI of a substructural element SE is no longer possible.

For this purpose, the first byte of the payload field of an IP data packet IP-P is defined as pointer Z. Thus, the substructural elements SE are only transmitted with the second byte of the payload field of an IP data packet IP-P. This pointer Z specifies the start address of the first substructural element SE, the cell header SH of which is located in the payload field of an IP data packet IP-P. This pointer Z can thus be used for restoring the synchronization between transmitter and receiver.

During a data transmission from a communication terminal KE1,…,KEn to the switching system PBX, the data to be transmitted are transmitted by the communication terminal KE1,…,KEn in the form of substructural elements SE to the IP hub IP-HUB associated with the communication terminal KE1,…,KEn. The substructural elements SE are inserted into data packets IP-P in accordance with the first or second conversion mode, respectively, in the access unit AE of the IP hub IP-HUB, the data packets IP-P exhibiting the IP address of the access unit AE associated with the switching system PBX in the packet header H. After that, the data packets IP-P are transmitted via the IP-oriented communication network IP-KN to the access unit AE associated with the switching system PBX. This access unit AE extracts the substructural elements SE contained in the received data packets IP-P and forwards the extracted substructural elements SE to the switching system PBX.

During a data transmission from the switching system PBX to a communication terminal KE1,…,KEn, the data to be transmitted are transmitted by the switching system PBX in the form of substructural elements SE to the access unit AE associated with the switching system PBX. In the access unit AE, the substructural elements SE are inserted into data packets IP-P in accordance

with the first or, respectively, second conversion mode, the data packets IP-P exhibiting in the packet header H the IP address of the IP hub IP-HUB associated with the

communication terminal KE1,…,KEn. The data packets IP-P are then transmitted via the IP-oriented communication network IP-KN to the IP hub IP-HUB addressed. In the access unit AE of the IP hub IP-HUB, the substructural elements SE contained in the received data packets IP-P are extracted and forwarded to the corresponding communication terminal KE1,…,KEn by means of the channel identifier CID stored in the substructural elements SE.

Due to the transmission of data combined in the substructural elements SE in accordance with the ATM adaptation layer AAL-Typ2 via the IP-oriented communication network IP-KN, there is no bi-directional conversion between the data format structured into substructural elements SE and the RTP data format normally used for transmitting voice data via the IP-oriented communication network IP-KN. In addition, the associated compression/decompression of the data does not take place either. Thus, an end-to-end transmission of voice data based on substructural elements SE via an IP-oriented communication network IP-KN is possible without loss of voice quality due to multiple compression and decompression of the voice data to be transmitted since the voice data are transmitted transparently, i.e. without processing in the substructural elements SE via the IP-oriented communication network IP-KN.

Patent claims

1. A method for transmitting data from communication terminals (KE1,…,KEn) via a packet-oriented communication network (IP-KN) to a switching system (PBX), the communication terminals (KE1,…,KEn) being connected to the packet-oriented communication network (IP-KN) via at least one hub (IP-HUB) and the switching system (PBX) via an access unit (AE), a data format formed of substructural elements (SE) being set up for a data transmission between the switching system (PBX) and the communication terminals (KE1,…,KEn),
in which a communication terminal (KE1,…,KEn) transmits the data to be transmitted in the form of substructural elements (SE) to the hub (IP-HUB) which inserts the substructural elements (SE) into data packets (IP-P) and the access unit (AE) extracts the substructural elements (SE) from the received data packets (IP-P) and forwards the extracted substructural elements (SE) to the switching system (PBX).

2. The method for transmitting data from a switching system (PBX) via a packet-oriented communication network (IP-KN) to communication terminals (KE1,…,KEn), the communication terminals (KE1,…,KEn) being connected to the packet-oriented communication network (IP-KN) via at least one hub (IP-HUB) and the switching system (PBX) via an access unit (AE), in which a data format formed of substructural elements (SE) is set up for a data transmission between the switching system (PBX) and the communication terminals (KE1,…,KEn),
in which the switching system (PBX) transmits the data to be transmitted in the form of substructural elements (SE) to the access unit (AE) which inserts the substructural elements (SE) into data packets (IP-P), and

in which the hub (IP-HUB) extracts the substructural elements (SE) from the received data packets (IP-P) and forwards the extracted substructural elements (SE) to the corresponding communication terminal (KE1,…,KEn).

3. The method as claimed in claim 1 or 2, characterized in that the data packets (IP-P) are structured as IP (Internet Protocol) data packets.

4. The method as claimed in one of the preceding claims, characterized in that the substructural elements (SE) in each case exhibit a cell header (SH) in which a channel identifier (CID) for designating an association of the substructural elements (SE) with a communication terminal (KE1,…,KEn) is stored and in which a length indicator (LI) for specifying the number of payload segments transmitted in a substructural element (SE) is stored.

5. The method as claimed in one of the preceding claims, characterized in that the substructural elements (SE) are structured according to the ATM (Asynchronous Transfer Mode) data format in accordance with a convention known as second ATM adaptation layer AAL-Typ2.

6. The method as claimed in one of the preceding claims, characterized in that, for the data transmission, the substructural elements (SE) are arranged in a payload area of a data packet (IP-P) in such a manner that a substructural element (SE) begins in a segment defined as the first payload segment of the IP data packet (IP-P).

7. The method as claimed in one of claims 1 to 5, characterized in that, in a segment defined as the first payload segment of an IP data packet (IP-P), a pointer (Z) is defined by means of which the start address of the first substructural element (SE) located in the payload area of an IP data packet (IP-P) is designated.

Abstract

Method for connecting communication terminals to a switching system via a communication network

The communication terminals (KE1,…,KEn) are connected to the packet-oriented communication network (IP-KN) via a hub (IP-HUB) and the switching system (PBX) is connected to the packet-oriented communication network (IP-KN) via an access unit (AE). A data format formed of substructural elements (SE) is set up for a data transmission between a switching system (PBX) and the communication terminals (KE1,…,KEn). The data to be transmitted in the form of substructural elements (SE) are inserted into data packets (IP-P) at the transmitter end for a data transmission via the communication network (IP-KN). The substructural elements (SE) are extracted from the received data packets (IP-P) at the receiver end.

Figure 1

ABSTRACT OF DISCLOSURE

The communication terminals are connected to the packet-oriented communication network via a hub and the switching system is connected to the packet-oriented communication network via an access unit. A data format formed of substructural elements is set up for a data transmission between a switching system and the communication terminals. The data to be transmitted in the form of substructural elements are inserted into data packets at the transmitter end for a data transmission via the communication network. The substructural elements are extracted from the received data packets at the receiver end. Accordingly, the data packets have been transmitted transparently with no compression/decompression and conversion according to the RTP protocol at the transmitter and receiver end.

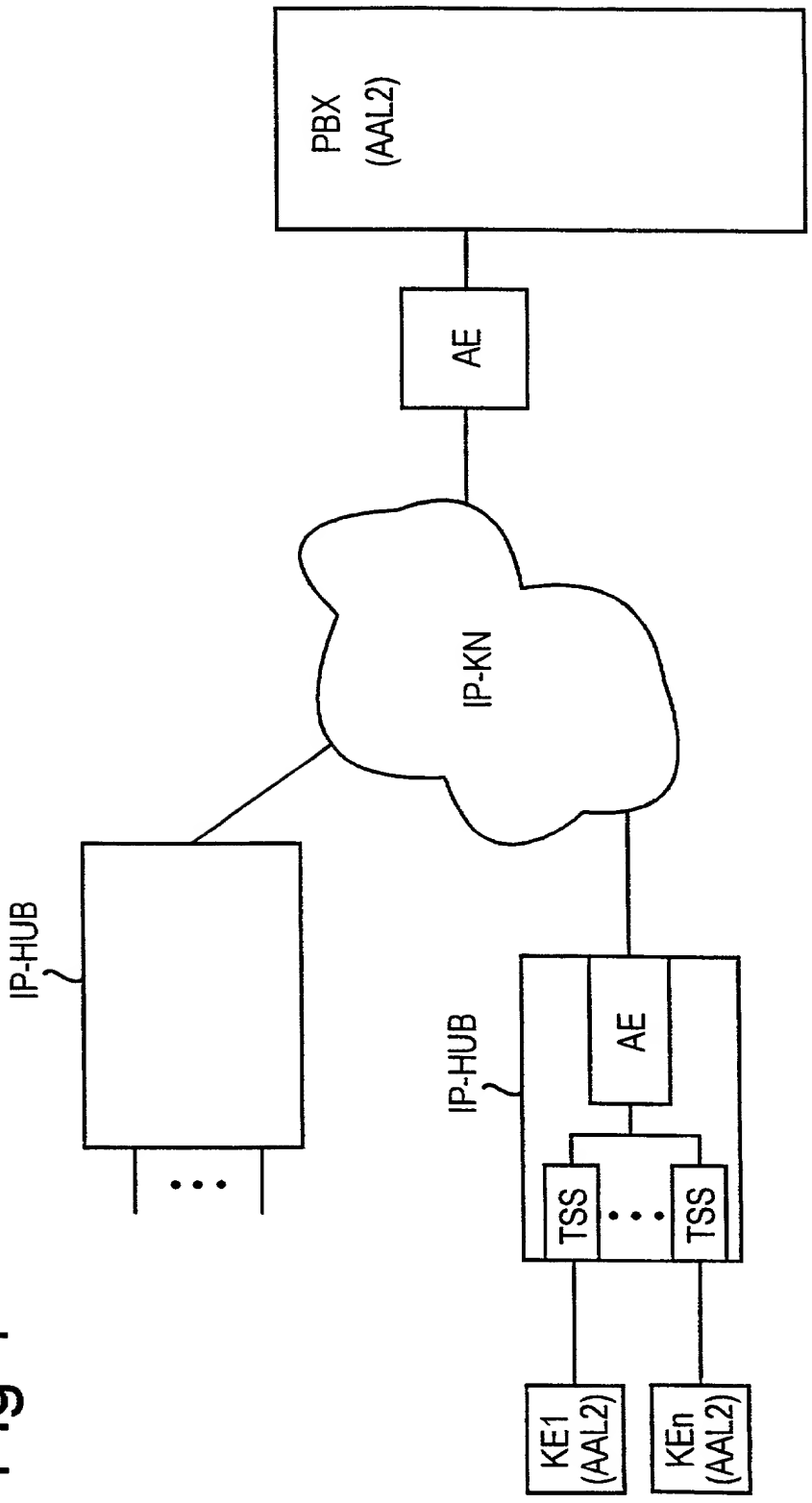


Fig 1

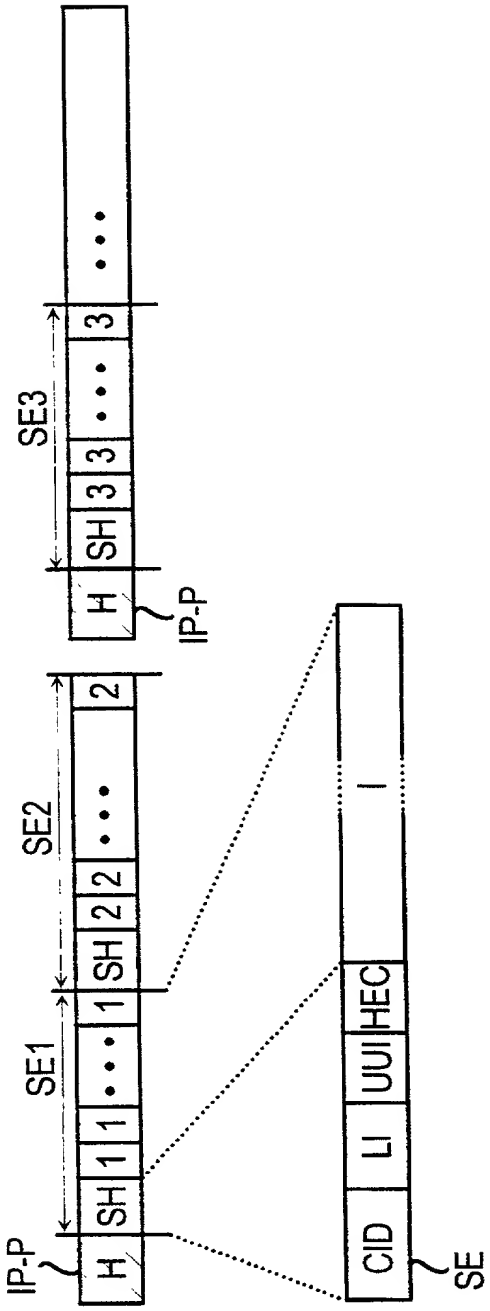


Fig 2

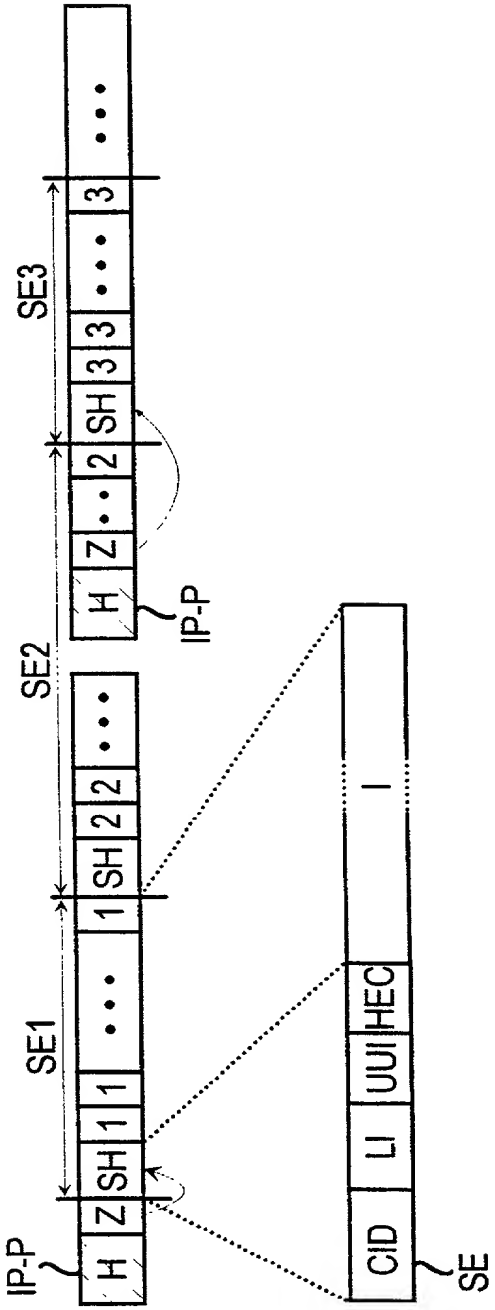


Fig 3

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren zum Anschließen von Kommunikationsendgeräten an eine Vermittlungsanlage über ein Kommunikationsnetz

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

(check one)

☒ hier beigefügt ist.

☒ is attached hereto.

☐ am _____ als PCT internationale Anmeldung PCT Anmeldungsnummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

☐ was filed on _____ as PCT international application PCT Application No. _____ and was amended on _____ (if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
198 45 038.9	Germany	30. September 1998	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der fruheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

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(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

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German Language Declaration

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

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Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address
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Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

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UNDER THE PATENT COOPERATION TREATY-CHAPTER II

CHANGE OF ADDRESS OF APPLICANTS' REPRESENTATIVE

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ATTORNEY DOCKET NO.:	P01,0047
INTERNATIONAL APPLICATION NO:	PCT/DE99/03056
INTERNATIONAL FILING DATE:	23 September 1999
INVENTION:	METHOD FOR CONNECTING TERMINALS TO A EXCHANGE VIA A COMMUNICATIONS NETWORK

Assistant Commissioner for Patents,
Washington D.C. 20231

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